

Claims

1. A method for monitoring of and fault detection in an industrial process, comprising at least a first sub-process and at least one second sub-process arranged in a process chain, comprising, for the at least one second sub-process the steps of collecting data and calculating a multivariate sub-model based on the collected data, said method being characterized by the steps:

- receiving in the first sub-process from the at least second sub-process information related to the multivariate sub-model calculated for the at least second sub-process,
- collecting data related to the first sub-process, and
- calculating a multivariate sub-model for the first sub-process based on collected data and received information.

15 2. A method according to claim 1, characterized by the step of transmitting information or data related to the multivariate sub-model calculated for the first sub-process to a third sub-process.

20 3. A method according to claim 1 and 2, characterized by the step of performing information or data feedback from the first sub-process to the at least one second sub-process.

25 4. A method according to any one of the preceding claims, characterized in that the data collected for each sub-process comprises process data.

5. A method according to claim 1, characterized in that the step of transferring information received comprises sequential transferring of quality parameters by means of multivariate sub-model score values ( $t_1, t_2, \dots, t_n$ ) between the sub-processes in the process chain.

30 6. A method according to any one of the preceding claims, characterized in that arranging the collected data for the first sub-process in one matrix and calculating the

sub-model for the first sub-process using a principal component analysis like method.

5        7. A method according to any one of the preceding claims, **characterized in that** arranging the collected data for the first sub-process is in a first (X) and a second (Y) matrix and calculating the sub-model for the first sub-process using a PLS like method.

10      8. A method according to claim 7, **characterized by** first matrix (X) comprises process data and the second matrix (Y) comprises quality data.

15      9. A method according to any one of the preceding claims, **characterized by** defining at least one plot, such as score plots, residual plots, residual standard deviation (DmodX) plots, contribution plots, or scaled raw data plots for the interpreting the models and occurring process faults.

10. A method according to claim 9, **characterized in that** outlier detection is provided by analysis of said at least one plot.

20      11. A method according to any one of the preceding claims, **characterized by** using a number of multivariate sub-model observations comprising a prediction set to simulate the process chain.

25      12. A method according to any of the preceding claims, **characterized by** using a number of multivariate sub-model observations comprising a prediction set to perform on-line monitoring in the process chain.

30      13. A first apparatus for monitoring of and fault detection in an industrial process employing multivariate data methods, said first apparatus comprising calculating means for calculating a first multivariate sub-model for a first sub-process, said first apparatus being **characterized in that** it comprises means for receiving from at least a second apparatus information or data related to at least second multivariate sub-

model calculated for at least a second sub-process in the industrial process and that said calculating means is arranged to calculate the first multivariate sub-model based on the information or data received from said apparatus and said second sub-process.

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14. A first apparatus according claim 13, characterized in that it comprises means for transmitting information or data to a third apparatus.

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15. An apparatus according to claim 13 and 14, characterized by means for performing information or data feedback to the second apparatus.

16. A computer program product comprising computer readable code means which, when run on a computer system, makes the computer system perform the following steps:

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- receiving information or data from a first sub-process
- receiving information or data related to a second multivariate sub-model calculated at a second sub-process
- calculating a first multivariate sub-model based on the data received from said second multivariate sub-model and said first sub-process.

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17. A computer program product according to claim 16 comprising computer readable code means which, when run on a computer system, makes the computer system perform the following additional step:

- transmitting relevant information or data to a third sub-process.

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